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NATO Defense Expenditures: Common Goals or Diverging Interests? A Structural Analysis

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This paper considers NATO defense expenditures with emphasis on the use of multiple structural change tests. By testing for structural breaks in defense expenditures, we determine the dates of change in the pattern of defense expenditures for the NATO allies. If NATO members are responding to a common threat, we expect to see similar breaks, in both direction and dates, for defense expenditures. The breaks should occur during major NATO strategy shifts such as the change from mutual assured destruction (MAD) to the doctrine of flexible response, and finally to the end of the cold war. We analyze whether NATO ally behavior is influenced by regional or alliance concerns.

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Keywords: Defense expenditures; NATO; Multiple structural changes; Defense Burden;

JEL Code: C22, H56, H77

INTRODUCTION

Much has been written recently about burden sharing and the growth of defense expenditures for the NATO allies. The distribution of defense expenditures among the allies raises questions about the role played by each nation in the collective defense effort that is the *raison d'être* of a military alliance. Olson and Zeckhauser (1966) apply the theory of public goods and determine that countries in an alliance stand to lose if their contributions to the alliance are determined by their national interests.

NATO has adopted a number of distinct defense strategies over the years that should have influenced the amount and level of contributions to the common defense. The allies adopted a doctrine of mutual assured destruction in the early years between 1949 and 1966. This doctrine essentially relied on US superiority in strategic nuclear weapons as a credible deterrent and automatic threat to counter any Soviet territorial expansion by attacking preemptively. The reliance on strategic weapons meant that NATO's security rested primarily with the US strategic forces.

As the Soviet Union began to build its strategic forces in the late 1960s and early 1970s, NATO changed its doctrine to that of flexible response. The allies prepared to defend themselves against conventional forces. As a result, strategic forces were supplemented with tactical and conventional forces to allow for a response that is commensurate to acts of aggression and could be escalated if needed. In addition, the pressure was on all NATO allies to build up their conventional forces and support US troops and military installations in Europe.

With the fall of the Berlin Wall in 1989 and the end of the Cold War, NATO no longer faced a common threat. The allies began downsizing to take advantage of a peace dividend. NATO's roles and responsibilities evolved during this period. Security concerns extended

beyond NATO's boundaries and new strategic doctrines were developed to deal with the emerging threats. The perceived challenges included managing crisis such as civil wars, disputes over natural resources, and natural disasters, peacekeeping missions, and nuclear, biological, and chemical arms control.

There are two issues this study will address by examining the ally's defense expenditure patterns from 1949 to 2002. The first issue is to ascertain if the three major changes in NATO doctrine and policy are reflected in changes in defense expenditures. The second is to determine whether the allies are pursuing ally specific defense agendas or acting as members of an alliance in a cooperative and common way. We do this by testing for shifts in the trend function of defense expenditure growth. A statistically significant shift, or structural break, indicates a change in defense expenditure patterns in response to policy changes. A downsizing in the military is a negative break in the trend function of expenditure growth. A positive break is indicative of an increase in the growth of defense expenditures. An expenditure growth after the break that is positive but less than the growth before the break represents a slowdown in military expenditures. A higher growth after a break indicates an expansion of the military. To address the first issue, we examine the date of the structural breaks in defense expenditures to determine if they correspond to the time frame of NATO policy change. If the NATO nations are behaving as members of an alliance and responding in a collective manner to threats, then the break dates (change points in defense expenditure growth) and direction of the breaks should be similar for the allies. The breaks in this study are determined using multiple structural change tests developed by Bai and Perron (1998, 2003). These tests determine the break date endogenously and allow up to a maximum of 5 structural shifts in the model. The newer members of the alliance, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania,

Slovakia, Slovenia, and Spain will not be included in the study since there is insufficient data to test.

With a few exceptions, the study provides no empirical evidence to suggest that NATO allies modified their behavior in any way to correspond to the three NATO doctrines. Only in the case of Belgium, the UK, and the USA do we see a decrease in expenditure growth in the early 1990s apparently in response to the end of the cold war. Greece and Portugal are the only nations with a break, in 1966, between MAD and flexible response. However, these breaks are more likely the result of domestic instability rather than a response to a change in NATO doctrine.

There is no evidence to suggest that NATO members are responding in a joint and concerted manner to threats. Structural breaks in defense expenditures for nearly every one of the NATO allies are associated with an ally specific defense agenda. Greece and Turkey exhibit the highest growth around 1974, when they both experience a structural break in their defense expenditure due to their preoccupation with Cyprus. Portugal has its highest growth between its first and second break, 1960 to 1966. This appears to correspond to its involvement in the colonies in Africa. Belgium and the Netherlands exhibit steadily decreasing growth rates after each break. The rest of the allies experience a mixture of downsizing and expansion in expenditure growth after structural breaks. All the allies, except for Germany, Greece, Portugal and Turkey, exhibit the highest mean defense expenditure growth before the first structural break regardless of when the break occurs. This growth comes at the height of the cold war. Germany exhibits the highest growth after the first structural break in 1958 three years after joining NATO in 1955. The last structural break appears to be followed by either a slowdown in growth or a downsizing for all the allies

The remainder of the paper is structured as follows. In the next section, we discuss the Theory of Alliances and its applicability to NATO. The third section reviews the multiple structural change tests and data. The fourth section presents the results. The last section concludes and offers policy advice.

Theory of Alliances

Military alliances are formed based on the logic of collective action. Allies need to prepare for action collectively and respond to threats collectively. Olson and Zeckhauser (1966) develop a model of organizations that are formed by nations to further their collective interests. They illustrate that larger nation members of organizations bear a disproportionate share of the financial responsibility for the collective organization. Such behavior threatens the independence of the organization and results in concern for the financial well being of the organization. In providing a good or service, an international organization, produces a public good for the members of the organization. All members of the organization automatically benefit from the public good and the good can be made available to other members of the organization at little or no marginal cost. The public good is non-rival and non-excludable. NATO's proclaimed purpose is to protect its member nations from aggression, with aggression against one of its members considered an aggression against the collective. The public good produced by NATO, deterring aggression, would be available to all its members and NATO should be able to expand its membership at little or no marginal cost. To test their theory that alliances provide public benefits, Olson and Zeuckhauser, find a significant positive correlation between GDP and military expenditures as a percentage of GDP for 1964 and conclude that GDP has a positive effect on military expenditures indicating that the larger NATO allies are

shouldering the smaller allies defense burdens. These results are descriptive of the doctrine of mutual assured destruction (MAD) characteristic of NATO between 1949 and the late 19660s when the reliance on strategic weapons meant that NATO's security rested primarily with the US strategic forces.

In the late 1960s and the 1970s, NATO moved from the doctrine of mutual assured destruction to that of flexible response which envisioned a measured response to acts of aggression and, if necessary, allowed for an escalation. The result was a shift from strategic to a combination of strategic, tactical, and conventional weapons. The public goods model no longer applied to NATO. The defense burden seemed to be shared more evenly between the larger and smaller allies, who were expected to maintain their conventional forces and defend themselves in the European theater. Researchers use the joint products model, which allows military expenditures to provide both public and private goods, to described this period. Sandler and Forbes (1980) describe a continuum of alliances with a purely deterrent on one extreme and a purely protective on the other. The closer an alliance is to the purely protective, the greater is the proportion of excludable benefits. The joint products model describes an alliance that is closer to the purely protective. They include both ability to pay and benefits received measures to an analyze behavior within an international organization. The proxies for ability to pay are military expenditure share of GDP, a measure of the internal burden of defense, and each allies' share of total NATO defense expenditures, a measure of the external burden of defense. The benefit proxies are the allies' shares of overall population, GDP, and exposed borders. They find that the dependence between GDP and ratio of defense expenditures to GDP supports a public goods model between 1960 and 1966. After 1967, the correlation between the two variables is weak indicating a shift from a deterrent alliance towards a more conventional cooperative

alliance. In addition, they find a shift of defense expenditures from the US to the European allies.

The flexible response era can be divided into two distinct time periods, 1967 to 1980 and 1981 to 1990 (Sandler and Murdoch, 2000). While the first time period is characterized by a joint products model, the second period is best described by a joint products model with some public benefits. 1981 to 1990 was the time of the Reagan procurement and strategic build up and the upgrading and modernizing of the British and French strategic forces. Khanna and Sandler (1996) and Sandler and Murdoch (2000) extend the analysis of NATO alliance behavior to include data covering the 1981 to 1990 time frame. They conclude that exploitation of the larger allies by the smaller allies increased due to the Reagan, British, and French strategic forces build up in the first half of the 1980s. However, the remainder of the period indicates NATO allies allocating defense spending based on nation specific concerns. The correlation between benefits received and defense burdens indicate a degree of cooperation in the alliance.

1990s to the present is characterized by the end of the cold war and the era of crisis management for NATO. The alliance no longer faced a common threat from the Warsaw Pact. The allies reduced defense expenditures to take advantage of a peace dividend. NATO's strategic doctrine changed to reflect the new realities. NATO allies identified the threat from rogue nations, ethnic conflicts, peacekeeping, and the non-proliferation of weapons of mass destruction as its priorities. Even though this period is still best characterized by a joint products model, more elements of public goods are appearing and the defense burden of the larger allies could increase. Sandler and Murdoch (2000) analyze NATO alliance behavior to include data up to 1999 and find insignificant correlation between economic size and defense burdens and a

match between defense burdens and proxy measures of defense benefits. This match is less significant for 1999 which is indicative of the increasing share of public benefits.

Amara (2005) studies the long run behavior of the NATO allies from 1949 to 2002 and concludes that despite the US defense burden being the largest in absolute value, Turkey and Greece are the two countries that have steadily increased their defense burdens. Even though the concept of a military alliance would imply that NATO should have an integrated response over the long run to defense issues, it appears that regional issues are the main drivers of military expenditures. Turkey and Greece are on the upper end of the defense burden and are clearly responding to defense concerns that are not shared by the remaining allies.

NATO

The North Atlantic Treaty signed in 1949, by Belgium, Canada, Denmark, France, Greece, Italy, Iceland¹, Luxemburg, Netherlands, Norway, Portugal, US, and the UK, established NATO as a cooperative defense organization with each ally contributing a share to the defense of the collective. Greece and Turkey joined NATO in 1952, West Germany in 1955, Spain in 1982, Czech Republic, Hungary, and Poland in 1999 and Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia in 2004. However, with most of its members still recovering from the devastation of World War II, the burden of NATO defense fell on the United States with the expectation that the allies would gradually increase their contribution.

NATO has undergone a rapid expansion during the last decade with a significant redrawing of the NATO border to the east. From an economic standpoint, the alliance should be expanded if the benefits of expansion are greater than the costs. When the new allies joined NATO it was assumed that they would eventually contribute to the security of the alliance and

share in the costs of defense burden.² The costs of expansion include the costs of modernizing the new member's forces, the cost of intelligence, equipment, training, cost of projecting NATO power to the new borders, the cost of communication and control. While these additional costs are to be picked up by the new and current members, it is highly unlikely that the economies of the new members will allow them to undergo this tremendous investment. Their defense budgets are small, their economies are fragile and in transition and their populations do not appear to support an increase in the proportion of government spending devoted to defense. They are not in a position to increase their military budgets to meet NATO's military requirements. Quite likely, the costs will be underwritten by the wealthier NATO allies. Instead of the new alliance members fully integrating into NATO, proposals have been made where each NATO member would specialize and provide a niche capability. However, it appears that NATO is leaning toward integrating new members into its structure.

We identify defining events during the three major periods of NATO doctrine that may have influenced ally defense expenditures in any way.

The first period, MAD, can be considered as starting from the creation of NATO in 1949 and lasting to 1966. The defining moments during this period:

- 1949: The ratification of the North Atlantic Treaty establishing NATO. The principal purpose of the alliance is specified in Article 5 which states that "an armed attack against one or more of them in Europe or North America shall be considered an attack against them all."

- 1952: In a meeting in Lisbon, NATO leaders agreed that the alliance needs capabilities equal to those of the Soviet Union and proposed that members specialize in providing certain services.

- 1953: Joseph Stalin, who had led the Soviet Union for almost 30 years, died and was succeeded by Nikita Khrushchev. These events seem to herald a thaw in East-West relations, particularly with the formulation of the Soviet policy of peaceful co-existence. Later that year, the USSR reveals its possession of the hydrogen bomb. Thus the United States loses its nuclear supremacy and with it the strong guarantee of Western security.

- 1954: The North Atlantic Council authorized NATO to use strategic weapons to counter any aggression.

- 1955: The Soviet Union concludes the Warsaw Treaty with Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland and Romania, and in December signs a treaty with the regime in East Germany transforming it into a State.

- 1956: The Hungary uprising is quickly suppressed by Soviet troops.

- 1961: East Germany begins building the Berlin Wall.

- 1962: sees the development of the Cuban missile crisis

- 1965: The North Atlantic Council meeting in Ministerial session in Paris accepts new procedures designed to improve the annual process of reviewing the defense efforts of member countries and agreeing upon their force contributions.

The second period, flexible response can be divided into two periods, 1967 to 1980 and 1981 to 1988. Flexible response can be considered as starting from the 1967 approval of the Harmel Report on the Future Tasks of the Alliance and ending with the end of the Cold War and the fall of the Berlin Wall in 1989.

- 1967: The Harmel Report on the Future Tasks of the Alliance is finalized. NATO decides to adopt a revised strategic concept to replace the massive retaliation doctrine. The new

strategy, flexible response, is based on a balanced range of responses involving the use of conventional as well as nuclear weapons.

- 1968: Czechoslovakia uprising suppressed by Soviets

- 1970: The US and the Soviet Union, having reached nuclear parity, seek to impose limitations on their respective nuclear arsenals. In 1970, the nuclear Non-Proliferation Treaty comes into force.

- 1972: An interim agreement on strategic arms limitations (SALT 1) and an anti-ballistic missile systems (the ABM Treaty) are both signed. Allied Ministers had agreed to begin multilateral talks in preparation for a Conference on Security and Cooperation in Europe.

- 1973: The Allies propose a common ceiling on the two sides' ground forces

- 1976: Allies express concern at the growth in the Warsaw Treaty's military strength, review national force contributions and agree to the need for further strengthening of NATO conventional defenses.

- 1978: NATO leaders agree to raise real defense spending by three percent annually to and adopt the Long Term Defense Program to ensure that the ability of the alliance to meet future needs.

- 1979: the SALT II agreement to curtail the manufacture of strategic nuclear weapons is signed.

- 1981: France and the UK begin to modernize their strategic nuclear forces and the Reagan administration embarks on a significant build up of the US military forces. The US accuses allies of not contributing fair share to collective security and US Senate threatens to reduce defense spending if the allies do not increase European defense

- 1989: Berlin wall falls marking the end of the Cold War.

The third period, Crisis Management Doctrine, 1990 to the present.

- 1991: During the Rome summit, the allies determine that NATO must assume responsibility for security challenges both within and beyond NATO boundaries. Gulf War is fought and the Communist regimes in Europe start to collapse.

- 1992: At the Oslo summit, peacekeeping is added as part of NATO's new strategic crisis management doctrine

- 1994: NATO broadens strategic doctrine to include the policing for the non proliferation of nuclear and other weapons of mass destruction

- 1995: NATO peacekeepers deployed in Bosnia

- 1999: NATO peacekeepers deployed in Kosovo

- 2003: Iraq war starts.

EMPIRICAL TESTS

To explain NATO military expenditures, a structural change test is used. Structural changes result from a discreet change in the population regression coefficients. Recent research on structural change in time series econometrics enables us to be explicit about the timing and the significance of the changes or breaks. A statistically significant break in the trend function of defense expenditures reflects a change in defense expenditure patterns in response to policy changes. The break can be negative indicating a downsizing in expenditure growth. A positive break is indicative of an increase in the growth of defense expenditures. If the NATO nations are behaving as members of an alliance and responding in a collective manner to threats and to major changes in NATO doctrine and policy, then the break dates (change in defense expenditure growth) and direction of the breaks should be similar for the allies. The breaks in

this study are determined using multiple structural change tests developed by Bai and Perron (1998, 2003). These tests determine the break date endogenously. Our interest is the presence of an abrupt structural change in the mean of the series. As such, we apply the following multiple linear regression with m breaks (and $m+1$ regimes):

$$y_t = x_t' \beta + z_t' \delta_j + \mu \quad t = T_{j-1} + 1, \dots, T_j$$

for $j = 1, \dots, m+1$ where y_t is the observed dependent variable at time t ; x_t ($p \times 1$) and z_t ($q \times 1$) are vectors of covariates and β and δ_j are the corresponding vectors of coefficients; μ_t is the disturbance at time t . The break points (T_1, \dots, T_m) are treated as unknown. For this study, $z_t = \{1\}$ and $q=1$, for the case of changes in the mean of a series and $p=0$ for a pure structural change model where all the coefficients are subject to change. We allow up to a maximum of 5 breaks and use a trimming of $\varepsilon = 0.10$. The model allows for serial correlation and different variances in the residuals across the segments resulting from the breaks.

The first test used is a *sup* Wald type test and is labeled $\sup F_T(l+1|l)$. It considers a null hypothesis of l breaks against the alternative hypothesis that an additional break exists, $l+1$. The *sup* F_T statistic is obtained by maximizing the difference between the sum of squared residual for the null and alternative hypothesis.³ For a model with l breaks, the estimated break points are obtained by a global minimization of the sum of squared residuals. The null hypothesis of l breaks is rejected in favor of the model with $l+1$ breaks if the overall minimal value of the sum of squared residuals for the alternative model is sufficiently smaller than the sum of squared residuals from the l break model. The break date selected is the one associated with the overall minimum. Bai and Peron (1998) report the critical values for the test.

The $\sup F_T(l+1|l)$ test requires the specification of a number of breaks for the null. Bai and Perron (1998) develop two tests where the number of breaks do not need to be pre-

determined. The double maximum tests consider a null hypothesis of no structural break against an unknown number of breaks given some upper bound of breaks. The two double maximum tests differ in their use of weights for the breaks. The weights reflect the imposition of prior conditions on the likelihood of various number of breaks. The first test, the equal weighted double maximum test $UD_{max}F_T$, gives equal weights of unity to all the breaks. The second, the weighted double maximum test $WD_{max}F_T$, recognizes that as m increases a fixed sample of data becomes less informative about the tested hypothesis since the critical values decrease leading to a test with low power. One way to alleviate this problem is to consider weights that equalize the marginal p values are equal for all m . There are no theoretical guidelines about the best choice of double maximum tests.

We follow the strategy recommended by Bai and Perron (2002) to first examine the double maximum tests to see if at least one break is present. If these two tests are significant and indicate the presence of at least one structural break, we determine the number of breaks by a sequential examination of the $\sup F_T(l+1|l)$ statistics. The statistics are constructed using global minimizers for the break dates and we ignore the $F(1|0)$ test. The selected m is such that the tests $\sup F_T(l+1|l)$ are insignificant for $l \geq m$. If the $\sup F_T(l+1|l)$ are insignificant and the double maximum tests are significant, the results indicate the presence of one structural break.

Data

NATO figures on military spending are highly reliable and use a common definition for defense. NATO has gone through the process of producing standardized figures that reflect expenditures for comparable categories for each country. The attempt at standardization is to assist in the assignment of defense burden sharing among the member countries.

Data for NATO military expenditures are from *NATO Review* which reports them in current year national currency. Military expenditure data are available from 1949-2004 for Belgium, Canada, Denmark, France, Greece, Italy, Luxemburg, Netherlands, Norway, Portugal, Turkey, UK and the US. Data for Germany is from 1953-2002. We use the CPI of each country as reported in the International Monetary Fund's *International Financial Statistics* May 2005 with 2000 as the base year to convert to real military expenditures. The data used is annual data expressed in logarithms

EMPIRICAL RESULTS

The two questions this study attempts to answer are whether the three major changes in NATO doctrine and policy are reflected in changes in defense expenditures, and whether allies are pursuing ally specific defense agendas or acting as members of an alliance in a cooperative and common way.

To answer the first question, we look for structural breaks in NATO defense expenditures that are descriptive of the theoretical underpinnings of the alliance behavior during the three periods. Therefore, we would expect two structural breaks for the allies. The first should occur around 1966/1967 with the transition from MAD to flexible response, and the second around 1989/1990 for the move from flexible response to crisis management. The MAD period when the reliance on strategic weapons meant that NATO's security rested primarily with the US strategic forces, should be characterized by US military expenditures growth and either NATO allies military expenditures growth or not. The flexible response era should be a period of defense expenditure growth for all the NATO allies who were expected to maintain their conventional forces and defend themselves in the European theater. The US should have either slower defense

spending growth or no growth at all. The last period, crisis management should be a period of either a slowdown or declining defense expenditure growth.

The results of the structural tests are summarized in Tables 1 to 6 and Figure 1. Table 1 details the structural break dates for NATO defense expenditures and their significance levels. Table 2 gives the average annual defense expenditure growth rates before and after each break. Tables 3 to 5 classify the growth rates into three classification; the first represents growth in defense expenditures which results if the average post-break growth is larger than the pre-break growth; the second represents slowdown in military expenditures if the average post-break growth is less than the pre-break and positive; the third represents downsizing in the forces if the post-break average is negative. Table 6 groups the breaks for each ally into the period in which they occur, MAD, flexible response, and crisis management. Figure 1 presents average and annual Defense Expenditure Growth.

The answer to the first question is quite mixed. It seems that the three major changes in NATO doctrine and policy are not reflected in changes in defense expenditures. The allies exhibit little of the expected characteristics in moving between the three periods. There are some exceptions. Greece and Portugal are the only nations with a break, in 1966, between MAD and flexible response. However, for Portugal, the average defense expenditure growth declines in the period after 1966 instead of growing as expected. During 1960s and early 1970s, Portugal was embroiled in conflicts in its colonies in Africa and was engaged in increasingly repressive domestic measures. It is more likely that the break is a result of an unsustainable military budget rather than a response to a change in NATO doctrine. Greece's break in 1966 probably anticipated the military coup d'état in 1967 rather than responded to NATO doctrine change. Greece's defense expenditure growth increases rapidly between 1966 and 1974 (the second

break). But this growth is more likely due to the two military coup d'états in 1967 and 1973 and to Greece's dispute with Turkey over Cyprus. Belgium, the UK, and the US display structural breaks in 1991, 1992, and 1990 respectively right after the fall of the Berlin Wall in 1989 and the beginning of the crisis management doctrine. The average defense expenditure growth for the US declined and Belgium and the UK both downsized. This is very consistent with the theoretical expectations for the period.

In answering the second question, we look for commonality in spending growth patterns and break dates that correspond to the timing of event of importance NATO. The growth of defense expenditures for all NATO allies except for Greece, Portugal, and Turkey is highest in the 1950s at the height of the cold war. There could be two explanations for the reasons behind the high growth. The first is that the allies are responding to NATO directives and acting as an alliance. The second is that the confrontation between East and West for the allies, except for Greece, Portugal, and Turkey, is the national security conflict of concern and for this period NATO's doctrine and the individual ally's security concerns coincide. Greece and Turkey did not perceive the East-West confrontation as their primary concern and Portugal was more preoccupied with the raging conflicts in Africa and its domestic troubles. During this time period, Canada, Denmark, Luxemburg, Norway, the UK and the US experience a structural break in 1953. While they all undergo a growth slowdown, Canada, Luxemburg, and the US actually undergo a downsizing. This could be due to the thaw in East-West relations that followed the death of Joseph Stalin in 1953 and the formulation of the Soviet policy of peaceful co-existence. It is worth mentioning at this point that another explanation for the break may be the conclusion of a cease fire in the Korean War in which the US, the UK and Canada were the NATO allies with the primary involvement.

Another commonality in defense spending growth comes after the last break for all NATO allies regardless of when the break occurs. All the allies have a slowdown or downsizing in growth following the last break. Belgium, the UK and the US have their last break in the early 1990s after the fall of the Berlin Wall and the commencement of the crisis management doctrine. Turkey had its last break in 1989 the year that military rule ended and a civilian president was elected. Portugal's last break in 1987 coincided with parliamentary elections that consolidated democracy and stressed the reduction of the government's role in the economy. Italy's last break in 1981 marks the end of domestic extremist left- and right-wing political terrorism. Greece's last break in 1974 marks the culmination of its confrontation with Turkey over Cyprus. Germany's last break in 1995 signals the financial pressure faced in its reunification with East Germany and the subsequent reduction in defense budgets. France's last break in 1977 could be the result of financial pressures on the government as a result of the economic turmoil faced by the nation. The reasons behind the timing of the last breaks for Canada, Denmark, Luxemburg, and Norway are less evident.

If we examine the breaks for the US:

- 1953 is followed by a downsizing and coincides with the end of the Korean War
- 1965 marks the start of the Vietnam War and a growth in defense expenditures
- 1970 is the year the nuclear Non-Proliferation Treaty comes into force and the beginning of troop reductions in Vietnam. The period is marked by downsizing.
- 1982 is the start of the Reagan buildup and a growth in defense expenditures
- 1990 marks the end of the cold war and a slowdown in growth.

If we examine the breaks for Turkey, the first two breaks in 1958 and 1969 come right before military take over of the government. The break in 1974 coincides with the Greek and Turkish

conflict over Cyprus. The break in 1979 occurs a year before a military coup. The last break in 1989 is followed by the smallest average defense expenditure growth and reflects the relative stability of Turkey's internal situation.

Portugal's breaks in 1960 and 1966 are reflective of its internal turmoil and preoccupation with its colonies in Africa. The third break in 1974 marks the conclusion of its commitment in Africa and 1987 marks elections and admission to the European Union.

Greece's break in 1966 occurs right before a military coup in 1967. Its second break in 1974 coincides with its conflict with Turkey concerning Cyprus.

France's first break in 1955 marks its defeat and withdrawal from Southeast Asia (Vietnam, Laos, and Cambodia). Its second break in 1963 marks the conclusion of the Algerian war of independence and the withdrawal from Algeria. Its breaks in 1972 and 1977 are probably not due to a single event but result from budgetary pressures on the government due to high inflation and high unemployment.

The reasons behind the breaks for the rest of the allies are less clear but are a combination of basically domestic economic issues and national security concerns.. The rest of the allies experience a mixture of downsizing and expansion in expenditure growth between the first and last structural break.

CONCLUSION

The North Atlantic Treaty establishing NATO specifies the principal purpose of the alliance in Article 5 which states that "an armed attack against one or more of them in Europe or North America shall be considered an attack against them all." This premise has never been challenged since no NATO member has suffered a direct attack necessitating a military response.

As such, one could conclude that NATO as an alliance has fulfilled its mission. Deterrence has worked. However, the policy of deterrence rests primarily with the US strategic forces and to a lesser extent with those of the larger allies such as the UK and France. A closer look at the behavior of even the three largest allies indicates a preoccupation with national issues over NATO issues.

The results of the structural analysis tests suggest that NATO allies do not have an integrated response to NATO specific defense issues. There is no evidence to suggest that NATO members are responding in a joint and concerted manner to threats or responding to the adoption of the three doctrine changes. Defense expenditure growth peaked at the height of the cold war in the fifties, except for Greece, Portugal, and Turkey. There is no indication that the NATO allies attempted to create forces capable of defense after the adoption of the flexible response doctrine. In fact, it appears that long before the formal end of the cold war, the allies were reducing the growth of defense expenditures. The last structural break for all the allies, no matter when it occurred, is followed either a slowdown or downsizing in defense expenditure growth.

Further efforts to study NATO should attempt to control for and isolate country specific effects. Instead of focusing on whether NATO members behave as allies, researcher should ascertain how much of their behavior is influenced by belonging to the alliance and in what manner. The question of interest becomes the issue of motivation. How do you motivate allies to conform and contribute to an alliance in an meaningful and productive way?

¹ Iceland maintains no military but its strategic location allows it to host NATO bases.

² Congressional Budget Office (CBO), 2000.

³ The $\sup F_T$ statistic is a generalization of the $\sup F$ statistic considered by Andrews (1993) and others for the case of one structural change.

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Table 1: Structural Break Dates for NATO Defense Expenditures

Country	Breaks	Break Year	supF(l+1 l)	WDmax	Udmax
Belgium	2	1969, 1991	8.64*		
Canada	1	1976	1.83	41.13***	20.50***
Denmark	3	1953,1961,1974	48.43***		
France	4	1955,1963, 1972, 1977	26.43***		
Germany	5	1958, 1963, 1971, 1978, 1995	15.16**		
Greece	2	1966, 1974	12.21**		
Italy	3	1961, 1970, 1981	36.95***		
Luxemburg	5	1953, 1958, 1975, 1986, 1996	26.70***		
Netherlands	1	1963	2.96	71.7***	37.7***
Norway	4	1953, 1964, 1974, 1984	17.70***		
Portugal	4	1960, 1966, 1974, 1987	45.66***		
Turkey	5	1958, 1969, 1974, 1979, 1989	6.52***		
UK	3	1953, 1973, 1992	11.56**		
USA	5	1953, 1965, 1970, 1982, 1990	12.69*		

Table 2: Prebreak and Postbreak Average Annual Defense Expenditure Growth Rates

Country	Mean Before First Break	Break Year				
Belgium		<i>1969</i>	<i>1991</i>			
	6.23%	1.54%	-2.44%			
Canada		<i>1976</i>				
	7.40%	0.97%				
Denmark		<i>1953</i>	<i>1961</i>	<i>1974</i>		
	20.30%	1.00%	3.70%	0.46%		
France		<i>1955</i>	<i>1963</i>	<i>1972</i>	<i>1977</i>	
	9.90%	4.70%	1.40%	3.50%	0.54%	
Germany		<i>1958</i>	<i>1963</i>	<i>1971</i>	<i>1978</i>	<i>1995</i>
	1.70%	22.70%	0.43%	2.56%	0.24%	-0.89%
Greece		<i>1966</i>	<i>1974</i>			
	4.65%	13.00%	1.50%			
Italy		<i>1961</i>	<i>1970</i>	<i>1981</i>		
	4.01%	4.34%	3.70%	-0.04%		
Luxemburg		<i>1953</i>	<i>1958</i>	<i>1975</i>	<i>1986</i>	<i>1996</i>
	41.00%	-1.90%	1.40%	3.90%	4.10%	3.54%
Netherlands		<i>1963</i>				
	5.60%	0.55%				
Norway		<i>1953</i>	<i>1964</i>	<i>1974</i>	<i>1984</i>	
	21.34%	0.67%	3.61%	2.88%	0.24%	
Portugal		<i>1960</i>	<i>1966</i>	<i>1974</i>	<i>1987</i>	
	6.27%	14.35%	6.77%	-3.41%	0.97%	
Turkey		<i>1958</i>	<i>1969</i>	<i>1974</i>	<i>1979</i>	<i>1989</i>
	12.24%	13.86%	24.26%	44.34%	7.87%	2.85%
UK		<i>1953</i>	<i>1973</i>	<i>1992</i>		
	15.80%	0.10%	0.50%	-1.16%		
USA		<i>1953</i>	<i>1965</i>	<i>1970</i>	<i>1982</i>	<i>1990</i>
	41.06%	-0.87%	19.10%	-0.06%	2.32%	0.57%

Note: The entries in columns 3 through 7 are the average annual defense expenditure growth rates after the break. The break dates are in italics.

Table 3: Classification of Postbreak Military Expenditure Growth Rates
Growth in Military Expenditures - Countries with Postbreak Growth Rates that Exceed Prebreak Rates

Country	Break Year	Average Growth Rates	
		Prebreak	Postbreak
Denmark	1961	1.00%	3.70%
France	1972	1.40%	3.50%
Germany	1958	1.70%	22.70%
	1971	0.43%	2.56%
Greece	1966	4.65%	13.00%
Italy	1961	4.01%	4.34%
Luxemburg	1958	-1.90%	1.40%
	1975	1.40%	3.90%
	1986	3.90%	4.10%
Norway	1964	0.67%	3.61%
Portugal	1960	6.27%	14.35%
	1987	-3.41%	0.97%
Turkey	1958	12.24%	13.86%
	1969	13.86%	24.26%
	1974	24.26%	44.30%
UK	1973	0.10%	0.50%
USA	1965	-0.87%	19.10%
	1982	-0.06%	2.32%

Table 4: Classification of Postbreak Military Expenditure Growth Rates
Slowdown in Military Expenditures - Countries with positive Postbreak Growth Rates that are less than Prebreak Growth Rates

Country	Break Year	Prebreak	Postbreak
Belgium	1969	6.23%	1.54%
Canada	1976	7.40%	0.97%
Denmark	1953	20.30%	1.00%
	1974	3.70%	0.46%
France	1955	9.90%	4.70%
	1963	4.70%	1.40%
	1977	3.50%	0.54%
Germany	1963	22.70%	0.43%
	1978	2.56%	0.24%
Greece	1974	13.00%	1.50%
Italy	1970	4.34%	3.70%
Luxemburg	1996	4.10%	3.54%
Netherlands	1963	5.60%	55.00%
Norway	1953	21.34%	0.67%
	1974	3.61%	2.88%
	1984	2.88%	24.00%
Portugal	1966	14.35%	6.77%
Turkey	1979	44.34%	7.87%
	1989	7.87%	2.85%
UK	1953	15.80%	0.10%
USA	1990	2.32%	0.57%

Table 5: Classification of Postbreak Military Expenditure Growth Rates
Downsizing in Military Expenditures - Countries with negative Postbreak Growth Rates

Country	Break Year	Average Growth Rates	
		Prebreak	Postbreak
Belgium	1991	1.54%	-2.44%
Germany	1995	0.24%	-0.89%
Italy	1981	3.70%	-0.04%
Luxemburg	1953	41.00%	-1.90%
Portugal	1974	6.77%	-3.41%
UK	1992	0.50%	-1.16%
USA	1953	41.06%	-0.87%
	1970	19.10%	-0.06%

Table 6: NATO Allies Structural breaks in the three NATO Doctrine Periods

Country	MAD 1949-1966	Flexible Response 1967-1989	Crisis Management 1990-
Belgium		1969	1991
Canada	1953, 1958	1976, 1983	1994
Denmark	1953, 1961	1974	
France	1955, 1963	1972, 1977	
Germany	1958, 1963	1971, 1978	1995
Greece	1966	1974	
Italy	1961	1970, 1981	
Luxemburg	1953, 1958	1975, 1986	1996
Netherlands	1963		
Norway	1953, 1964	1974, 1984	
Portugal	1960, 1966	1974, 1987	
Turkey	1958	1969, 1974, 1979, 1989	
UK	1953	1973	1992
USA	1953, 1965	1970, 1982	1990

Figure 1: Average and Annual Defense Expenditure Growth

